

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCHING AUTHORITY

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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/EP2004/010980

International filing date (day/month/year)
29.09.2004

Priority date (day/month/year)
03.10.2003

International Patent Classification (IPC) or both national classification and IPC
G02B6/14

Applicant
SOCIETE ANONYME ALCATEL

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/EP2004/010980

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:

☐ a sequence listing

☐ table(s) related to the sequence listing
 - b. format of material:

☐ in written format

☐ in computer readable form
 - c. time of filing/furnishing:

☐ contained in the international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

WRITTEN OPINION OF THE
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International application No.
PCT/EP2004/010980

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-10
	No: Claims	
Inventive step (IS)	Yes: Claims	1-10
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-10
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item V.

- 1 The following documents are referred to in this communication:

D1 : WO 03/079063 A (YONSEI UNIVERSITY ; CHOI WOO-YOUNG (KR); LEE KWANG-HYUN (KR)) 25 September 2003 (2003-09-25)
D2 : US 5 185 827 A (POOLE CRAIG D) 9 February 1993 (1993-02-09)
D3 : WO 00/51268 A (LASERCOMM INC) 31 August 2000 (2000-08-31)
D4 : EP 1 271 194 A (FITEL USA CORP A DELAWARE CORP) 2 January 2003
D5 : US 6 269 205 B1 (PERAL EVA ET AL) 31 July 2001 (2001-07-31)

- 2 Document D1, which is considered to represent the most relevant state of the art, discloses (the references in parentheses applying to this document):

an optical device (see in particular fig. 2 and page 5 ,lines 14-25) for transforming the propagation mode of optical signals, comprising at least a first mode converter (30) associated with a multimode fibre (16;the dispersion compensation fiber supports two modes), the first converter (30) being supplied with signals propagating in accordance with a first guided mode and delivering those signals in the multimode fibre (16) partly in the first guided mode and partly in a second guided mode of a higher order than the first one.

- 2.1 From this, the subject-matter of independent claim 1 differs in that:
the multimode fibre comprises first passive filtering means arranged to convert the first guided mode into a dissipative cladding mode(s) in order to prevent or limit the propagation of the signals in this first guided mode while at the same time authorising the propagation of the signals in the second guided mode in the multimode fibre.
- 2.2 The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).
The problem to be solved by the present invention may be regarded as:
to provide an improved mode converter by suppressing the propagation of the remaining part of the undesirable order mode as a result of conversion in the

first mode converter and leaving the signal in the converted higher order mode unattenuated.

The ratio between the energy transmitted in the undesirable lower order mode to the energy transmitted via the higher order mode becomes smaller than by only using first mode converter not capable of 100% conversion of power from lower order mode into one selected higher order mode.

2.3 The solution to this problem proposed in claim 1 of the present application consists in adding to an existing mode converter passive filtering by carrying out power coupling between the first guided mode and one or more cladding modes in a transformation device in a multimode fiber serving as passive filtering.

Another close state of the art document is the document D2. It discloses (see in particular figure 3 and column 6, line 49-column 7, line 10) dispersion compensation device comprising a mode converter (11) and a mode controller (18). The function of the mode controller (18)-as opposed to the invention-is not to filter out the remaining part of the fundamental mode of the preceding mode converter (11) but to permit the adjustment of the spatial mode excitation in the succeeding dispersive waveguide element (12) by rotating it (improvement of the coupling efficiency of higher order mode).

None of the prior art documents cited in the search report do provide hints or suggestion(s) at such a solution to this problem.

The subject-matter of the independent claim 1, therefore, involves an inventive step (Art. 33(3) PCT).

2.4 Claims 2-10 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

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AUTHORITY (SEPARATE SHEET)

International application No.

PCT/EP2004/010980